SYNOPSIS OF *CAREX* SECTION *LUPULINAE* (CYPERACEAE) IN TEXAS

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ABSTRACT

Five species of *Carex* section *Lupulinae* occur in Texas; *C. lupulina, C. lupuliformis, C. louisianica, C. intumescens* and *C. gigantea*. *Carex lupulina* is the most common and widespread of the five. *Carex lupuliformis*, which is rare, grows mostly in calcareous sites in swampy woodlands. It has been recorded only in the northeast corner of the state in Bowie and Marion counties. *Carex louisianica* occurs infrequently in the eastern 1/3 of Texas growing in acidic soils of swampy woods or bottomland hardwood forests. *Carex intumescens* is widespread across the distributional range of section *Lupulinae* in Texas but is infrequent within its diminishing habitat of acidic bottomland hardwood forests. In Texas, *C. gigantea* is the rarest member of the section having not been collected for 46 years. The only two collections were made in Harris and Polk counties in acidic swampy woodlands. An artificial dichotomous key, county distribution maps and comparable species descriptions are provided.

INTRODUCTION

Carex, with 31 sections represented by more than 80 species, is the largest genus of vascular plants in Texas. As is the case with most genera of the family Cyperaceae, *Carex* is difficult taxonomically. The section *Lupulinae* (J. Carey) Mackenzie is endemic to central and eastern North America (Reznicek and Ball 1974). It is restricted to the eastern 1/3 of Texas, being found westward to Hays County and southward to Nueces County. However, the greatest concentration and diversity are found in the eastern 1/5 of the state. Section *Lupulinae* in the subgenus *Carex* has 3 stigmas, trigonous achenes, and unisexual spikes. Other characteristics of this section include perigynia 1 cm long or longer, coarsely nerved perigynia, a perigynium-body that is ovoid or globose-ovoid, and leaf blades that are strongly septate-nodulose.

Six species have been recognized in this section by Mackenzie (1935, 1940), Fernald (1950), Gleason (1952), Voss (1972), Reznicek and Ball (1974) and Menapace et al. (1986). Five occur in Texas: *C. lupulina* Willd., *C. lupuliformis* Sartwell, *C. louisianica* Bailey, *C. intumescens* Rudge and *C. gigantea* Rudge. The remaining species *C. grayi* Carey is found immediately east and northeast of Texas and from the Gulf states north to southwestern Quebec. Waterfall (1979) listed *C. grayi* as occurring in

Sida 14(1):87 – 99. 1990.

Oklahoma. Rob Naczi (MICH; per. comm.) has recently collected it in McCurtain County, Oklahoma (Naczi 1890, MICH). Tony Reznicek (MICH; per. comm.) has collected *C. grayi* (*Reznicek 8490*, MICH) along the Little River in Sevier County, Arkansas. He stated, not only is it found immediately adjacent to Texas, but it quite likely occurs locally in river bottoms in extreme northeastern Texas, although it has not yet been collected there.

Correll and Johnston (1970) recognized *C. intumescens* Rudge, *C. gigantea* Rudge, and *C. lupulina* Muhlenb.. *Carex lupuliformis* Sartwell and *C. louisianica* Bailey were recognized as forms of *C. lupulina* Muhlenb.. They referred to Muhlenberg as the authority for *C. lupulina* as have other authors. However, Reznicek and Ball (1974) stated that Willdenow is the correct authority.

The primary objective of this paper is to examine the taxonomic status of *C. lupuliformis* and *C. louisianica* in the Texas flora. Other objectives are to provide distribution maps by county for each of the five species occurring in Texas and provide comparable diagnosis for each of the five taxa. The distribution maps were based on herbarium specimens.

METHODS AND PROCEDURES

This study was based on about 300 specimens examined from the following herbaria: (acronyms follow Holmgren et al. 1981) ASTC, MO, NLU, SHST, SMU, SWT, TAES, TAMU, TEX, UA and US. In addition, an isotype of *C. lupuliformis* was examined from PH. Field trips to east and southeast Texas were conducted throughout 1988 to supplement existing distribution and habitat records. Dorsal and ventral are used synonymously with abaxial and adaxial in this paper. Maturation dates are given as opposed to flowering dates because mature plants in fruit are used to establish the diagnostic characters in all previously published artificial keys for Cyperaceae.

Micrographs were taken of representative achenes of each species using a JOEL-25s scanning electron microscope. Achenes were mounted on aluminum stubs via doubled sided tape and coated with 400 Å of gold-palladium using a Hummer 1 sputter coater. Micrographs were taken at an accelerating voltage of 12.5 Kv's. Photographs of the pistillate and staminate spikes were taken from herbarium sheets using a 35 mm Canon AE-1 single lens reflex camera with Kodak MTAX film (100 ASA).

Species descriptions will be abbreviated to reflect characters that are diagnostic or which can be used in conjunction with other characters to distinguish between *C. lupulina, C. lupuliformis* and *C. louisianica*, or where new previously unrecorded information is provided. The chosen characters

will be given for all five Texas species. For a recent and complete species description of the section see Reznicek and Ball (1974).

RESULTS

KEY TO THE SPECIES

1a. Pistillate spike outline tending to be globose (Fig. 1c); perigynia loosely arranged, spreading, drying dark olive-drab green ..... 4. *C. intumescens*

1b. Pistillate spike outline oblong to cylindric (Figs. 1a,b,d,e); perigynia either loosely arranged or not, drying stramineous, green or light olive-drab green.

2a. Staminate peduncles greatly exceeding the uppermost pistillate spike (Fig. 1d); perigynia loosely arranged, ascending-spreading ..... 3. *C. louisianica*

2b. Staminate peduncles shorter than to only slightly exceeding the uppermost pistillate spike (Figs 1a,b,c); perigynia either loosely arranged or tightly arranged.

3a. Achenes distinctly wider than long (Fig. 2c), widest above the middle, subtruncate to truncate apically; perigynia loose to tightly arranged, usually spreading at right angles to the main axis (Fig. 1e) ..... 5. *C. gigantea*

3b. Achenes as wide as long or longer, widest near the middle, not subtruncate or truncate apically, perigynia tightly arranged, ascending or slightly spreading but usually not at right angles to main axis.

4a. Angles of achene smoothly curved (Fig. 2a), not knobbed, faces flat to slightly concave. ..... 1. *C. lupulina*

4b. Angles of achene pointed (Fig. 2d), with nipple-like knobs, faces strongly concave ..... 2. *C. lupuliformis*

1. CAREX LUPULINA Willd., "HOP-SEDGE", Sp. Pl. 4:266. 1805. TYPE: *Willdenow 17210* (HOLOTYPE: B, photo only TRTE).

Blades flat, 1.5 − 6.4 dm long × 4 − 15 mm wide, long-attenuate, antrorsely scabrous distally on the adaxial and abaxial sides on the nerves, strongly antrorsely scabrous on margins of upper half, septate-nodulose. Bracts leaf-like, flat, 10 − 55 cm long × 2 − 11 mm wide, much exceeding the culm, antrorsely scabrous on the margins distally, the lower, at least strongly sheathing, septate-nodulose. Pistillate infructescence (Fig. 1a), below staminate spike, (1-)2 − 5 per culm, not aggregated, 1.5 − 6.5 cm long × 1.3 − 3 cm wide, oblong; peduncles 0.5 − 20 cm long, distance between 2 lowest peduncles 1 − 20 cm. Staminate inflorescence terminal, 1 or rarely 2 per clum, 1.5 − 8.5 cm long × 1 − 5 mm wide, narrowly linear; peduncles 0.5 − 6 cm long, antrorsely scabrous, base of staminate spike shorter than or barely exceeding the top of the uppermost pistillate spike; anthers 2 − 4 mm long. Pistillate scales 6 − 15 mm long × 1 − 2.7 mm wide, lanceolate to lanceolate-ovate, 1 − 7-nerved, nar-

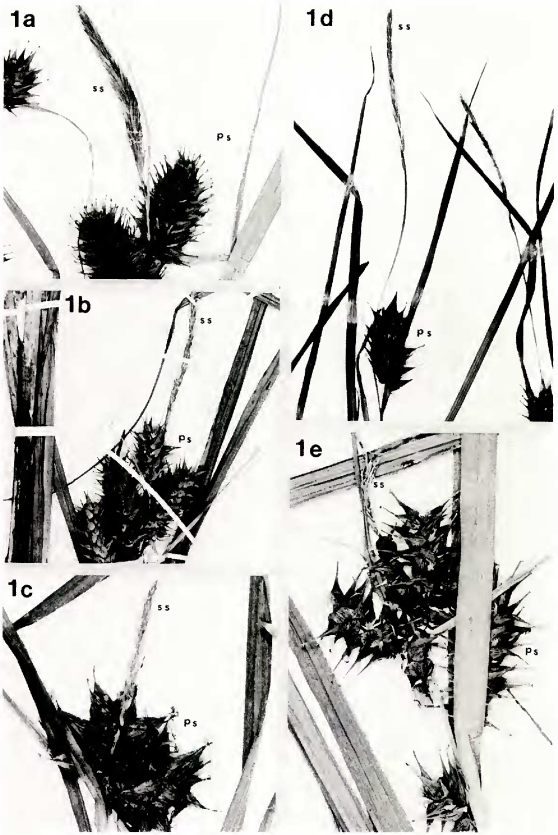

FIG. 1. a – e. Pistillate spike (ps) and staminate spike (ss). 1a. *Carex lupulina*, 1b. *C. lupuliformis*, 1c. *C. intumescens*, 1d. *C. louisianica*, 1e. *C. gigantea*.

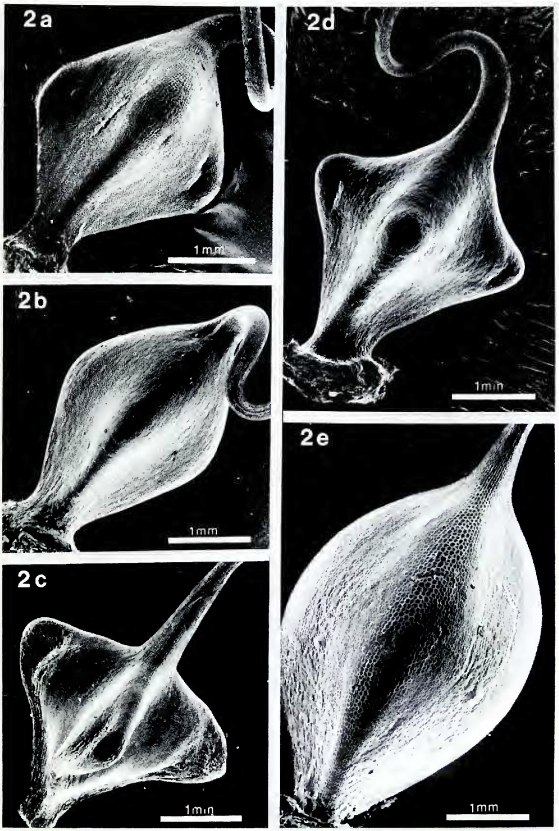

FIG. 2. a–e. Achenes. 2a. *Carex lupulina*, 24×. 2b. *C. louisianica*, 23×. 2c. *C. gigantea*, 23×. 2d. *C. lupuliformis*, 23×. 2e. *C. intumescens*, 23×.

rower and shorter than perigynia, white hyaline with green centers, acute to awned, awns to 6 mm long, antrorsely scabrous. Perigynia 11 – 19 mm long × 3 – 6 mm wide, narrowly ovoid, glabrous, shiny, light to medium green to stramineous at maturity, wingless, not corky, inflated, stiffly erect to strongly spreading, sessile to ± stipitate, (4-) 8 – 80 per spike, strongly 13 – 22-nerved; beak conic, 6 – 10 mm long, bidentate. Achenes (Fig. 2a) 3 – 4(-4.5) mm long × 1.7 – 2.8 mm wide, rhomboid, trigonous, ± stipitate, faces flat to concave, angles thickened internally. Distribution: Minnesota to Nova Scotia and south to Florida and Texas. Texas: by counties (Fig. 3b); regions 1,2,3 and 4 as defined by Gould (1975). Chromosome number $2n = 56$ (Reznicek and Ball 1974) $n = 30$ (Wahl 1940). Since *C. lupuliformis* has a chromosome number of $2n = 60$, Reznicek has suggested that it is possible that Wahl may have had that species instead of *C. lupulina*. Maturation dates: April through October. Habitat: Open swamps, wet ditches, somewhat acidic-neutral to calcareous soils.

Representative specimens: **Angelina Co.**: 25 Jun 1980, *J. Ward & S. Hupp 459* (ASTC). **Bowie Co.**: 06 Aug 1983, *E. Nixon. J. Ward & M. McCrary 12493* (ASTC). **Brazos Co.**: 11 May 1980, *P. Fryxell 3181* (SMU). **Cass Co.**: 18 Jul 1967, *R. Mitchell 3250* (TEX). **Freestone Co.**: 28 Oct 1983, *E. Nixon & J. Ward 13170* (ASTC). **Galveston Co.**: 06 May 1976, *F. Waller 3808* (TEX). **Gonzales Co.**: 04 Aug 1941, *B. Tharp 47561* (TAES). **Grimes Co.**: 10 Jul 1988, *S. & G. Jones 1818* (ASTC). **Hardin Co.**: 21 May 1986, *L. Brown 10006* (ASTC). **Harris Co.**: 21 May 1986, *L. Brown 10006* (ASTC). **Harrison Co.**: 09 Aug 1980, *E. Nixon 10496* (ASTC). **Hays Co.**: Summer 1928, *G.M.W. s.n.* (SWT). **Henderson Co.**: 08 May 1970, *D. Correll & H. Correll 38642* (TEX). **Hopkins Co.**: 08 Jun 1953, *L. Shinners 15054* (SMU,TEX-LL). **Houston Co.**: 10 Jun 1970, *D.Correll & H. Correll 38939* (TEX). **Jasper Co.**: 07 Jun 1981, *J. Kessler 4527* (TAES). **Jefferson Co.**: 21 May 1948, *J. Brenckle 48023* (SMU,TEX). **Lamar Co.**: 16 Jul 1968, *D. Correll & H. Correll 35913* (TEX). **Liberty Co.**: 25 Apr 1941, *R. Crockett 937* (TEX). **Nacogdoches Co.**: 15 Jul 1964, *F. Waller, Jr. 183* (TAES). **Newton Co.**: 21 May 1967, *J. Crutchfield 2585* (TEX). **Orange Co.**: 19 Jul 1946, *D. Correll 13342* (TEX). **Polk Co.**: 11 May 1988, *S. Jones & J. Wipff 1493* (ASTC,TAES). **Red River Co.**: 21 Jul 1969, D. Correll 37501 (TEX). **Robertson Co.**: 15 Aug 1982, *T. Starbuck 2974* (TAMU). **Sabine Co.**: 19 May 1970, *D. Correll & H. Correll 38765* (TEX). **San Augustine Co.**: 11 Apr 1987, *E. Nixon 16194* (ASTC). **Shelby Co.**: 17 May 1988, *S. & G. Jones & E. Nixon 1376* (TAES). **Trinity Co.**: 25 Apr 1988, *E. Nixon 16411* (ASTC,TAES). **Upshur Co.**: 09 Aug 1950, *V. Cory 57724* (SMU). **Walker Co.**: 15 Jun 1968, *J. Bhatt 54* (TAMU). **Wood Co.**: 26 Aug 1985, *E. Nixon 14967* (ASTC).

2. CAREX LUPULIFORMIS Sartwell, "HOP-LIKE SEDGE", Carices Amer. Sept. Exsiccatae, 2: No. 147. 1848 (BASIONYM: *C. lupulina* Willd. var. *polystachia* Schwein. & Torrey). TYPE: (HOLOTYPE: NY; ISOTYPES: BM, PH!).*C. lupulina* Willd. var. *polystachia* Schwein. & Torrey, Ann. Lyceum Nat. Hist. New York 1:337. 1825. *Carex lurida* Wahl. var. *polystachta* (Schwein. & Torrey) Bailey, Proc. Amer. Acad. Arts 22:63. 1886.

Bracts leaf-like, flat, 20 – 70 cm long × 4 – 11 mm wide, much ex-

ceeding the culm, antrorsely scabrous on the margins, sheathing rarely absent, septate-nodulose. Pistillate infructescence (Fig. 1b), below staminate spike, occasionally with staminate above, 2 – 6 per culm, not aggregated, 2 – 8 cm long × 1.5 – 3 cm wide, the uppermost usually overlapping for most of their length, oblong or cylindric; peduncles 1 – 13 cm long, smooth, distance between 2 lowest penduncles 2 – 17 cm. Staminate inflorescence terminal, occasionally below pistillate, 1 or 2 per culm, 2 – 10 cm long × 2 – 5 mm wide, narrowly linear, peduncles 1 – 12 cm long, smooth, base of staminate spike shorter than or barely exceeding the top of the uppermost pistillate spike; anthers 2.5 – 3 mm long (based on 2 specimens). Pistillate scales 6 – 13 mm long × 1.8 – 3.2 mm wide, lanceolate, 3 – 7-nerved, narrower and usually shorter than the perigynia, brownish-hyaline with darker stramineous centers, tapering into an awn, awn to 5.5 mm long, antrorsely scabrous. Perigynia 12 – 18 mm long × 3.8 – 6 mm wide, ovoid, glabrous, shiny, dull-green when immature to brownish-yellow at maturity, wingless, not corky, strongly inflated, ascending to slightly spreading, sessile, 8 – 75 per spike, strongly 17 – 25-nerved; beak conic, 6 – 9 mm long, bidentate. Achenes (Fig. 2d) 3 – 4.5 mm long × 2.4 – 3.4 mm wide, rhombic, trigonous, ± stipitate, faces concave, angles thickened internally with prominent nipple-like knobs. Distribution: Northward to Quebec, as far south as Florida and westward to Texas: Texas: by counties (Fig. 3c); regions 1 and 3, known only from Bowie and Marion counties; rare. It is never common within its range. Chromosome number $2n = 60$ (Reznicek and Ball 1974). Maturation dates: The only Texas dates are September and October. In conjunction with specimens examined from other states and Steyermark (1968) the maturation dates are June-October. Habitat: Swampy woodlands, mostly in calcareous sites.

Representative specimens: **Bowie Co.**: 28 Sep 1948, *E. Whitehouse 20450* (SMU). **Marion Co.**: Jul 1962, *D. Correll 26409* (TEX).

3. Carex louisianica Bailey, "LOUISIANA SEDGE," Bull. Torrey Bot. Club 20:428. 1893 (based on *C. balei* Carey). Type: (holotype: K).

Blades flat, 1 – 40 cm long × 2 – 6 mm wide, long-attenuate, glabrous, upper half antrorsely scabrous on the margins, septate-nodulose. Bracts leaf-like, flat, 10 – 30 cm long × 2 – 4 mm wide, much exceeding the culm, margins antrorsely scabrous, sheathing, septate-nodulose. Pistillate infructescence (Fig. 1d), below staminate spike, 1 – 4 per culm, not aggregated, 1.5 – 4.5 cm long × 1.5 – 2.5 cm wide, subcylindric to cylindric; peduncles 0.5 – 5 cm long, smooth, distance between lowest 2 peduncles 2 – 10 cm. Staminate inflorescence terminal, 1 per culm,

0.5 – 7 cm long × 1.5 – 3 mm wide, narrowly linear; peduncles 3 – 10 cm long, with sparse antrorse scabrosity, base of staminate spike much exceeding the top of the uppermost pistillate spike; anthers 2.5 – 3.3 mm long. Pistillate scales 4.5 – 6.5 mm long × 1.5 – 2 mm wide, lanceolate-ovate 3 – 7-nerved, narrower and shorter than the perigynia, white hyaline with a green center stripe, long tapering apically. Perigynia 10 – 14 mm long × 3.5 – 6 mm wide, ovoid, glabrous, shiny, dull green when immature to stramineous at maturity, wingless, not corky, strongly inflated, stiffly ascending to somewhat spreading, sessile, 10 – 30 per spike, strongly 15 – 18-nerved; beak conic, 4.5 – 7 mm long, bidentate. Achenes (Fig. 2b) 2.5 – 3.5 mm long × 1.7 – 2 mm wide, rhomboid, trigonous, broadly stipitate, faces nearly flat, angles thickened internally. Distribution: Florida to Texas, northward to Indiana and east to the mountains of New Jersey. Texas: by counties (Fig. 3d); regions 1,2,3 and 4. Chromosome number unknown. Maturation dates: April through August. Habitat: Swampy woods, bottomland hardwood forests, acidic soils.

Representative specimens: **Bowie Co.**: 06 Aug 1983, *E. Nixon, J. Ward & M. McCrary 12401* (ASTC). **Fannin Co.**: 27 Apr 1959, *K. Rochart & B. Sinclair 70* (TEX). **Gregg Co.**: 14 Jul 1942, *C. York s.n.* (TEX). **Hardin Co.**: 28 Mar 1982, *J. Matos & D. Rudolf 344* (ASTC). **Harris Co.**: 08 May 1982, *J. Kessler 5684* (TAES). **Jefferson Co.**: 20 May 1948, *J. Brenckle 48024* (SMU); 29 Apr 1936, *J. Steyermark 36120* (SMU). **Liberty Co.**: 13 Apr 1972, *R. McFarlane 27* (ASTC). **Newton Co.**: 18 Apr 1958, *A. Traverse 525* (SMU, TEX). **Orange Co.**: 22 May 1988, *S & G. Jones 1640* (ASTC, TAES). **Panola Co.**: 17 May 1967, *J. Crutchfield & E. Nixon 2737* (TEX). **Polk Co.**: 12 Apr 1941, *E. Girvin s.n.* (TEX). **Robertson Co.**: 27 Apr 1982, *T. Starbuck 1853* (TAES,TAMU). **San Jacinto Co.**: 14 Apr 1972, *E. Nixon s.n.* (ASTC). **Trinity Co.**: 17 Jul 1936, *Goodrum s.n.* (TEX). **Walker Co.**: 10 May 1941, *S. Warner 9* (TEX). **Wood Co.**: 18 May 1988, *S. & G. Jones & E. Nixon 1426* (TAES).

4. Carex intumescens Rudge, "BLADDER SEDGE", Trans. Linn. Soc. London 8:97. 1804. Type: (holotype: BM; isotype: BM).

Blades flat, 9 – 30 cm long × 3 – 9 mm wide, long-attenuate, glabrous,upper half antrorsely scabrous on the margins, septate-nodulose. Bracts leaf-like, flat, 5.5 – 22 cm long × 2 – 6 mm wide, much exceeding the culm, antrorsely scabrous on the margins, sheathless, rarely with short sheaths, septate-nodulose. Pistillate infructescence (Fig. 1c), below staminate spike, 1 – 4 per culm, aggregated, 1 – 2.7 cm long × 1 – 2.8 cm wide, globose to subglobose; peduncles 0.3 – 1.5 cm long, antrorsely scabrous, distance between lowest 2 peduncles 0.2 – 2.1 cm; staminate inflorescence terminal, 1 per culm, 1 – 5 cm long × 1 – 3 mm wide, narrowly linear; peduncles 0.5 – 4 cm long, antrorsely scabrous, base of staminate spike may or may not exceed the top of the uppermost pistillate spike;

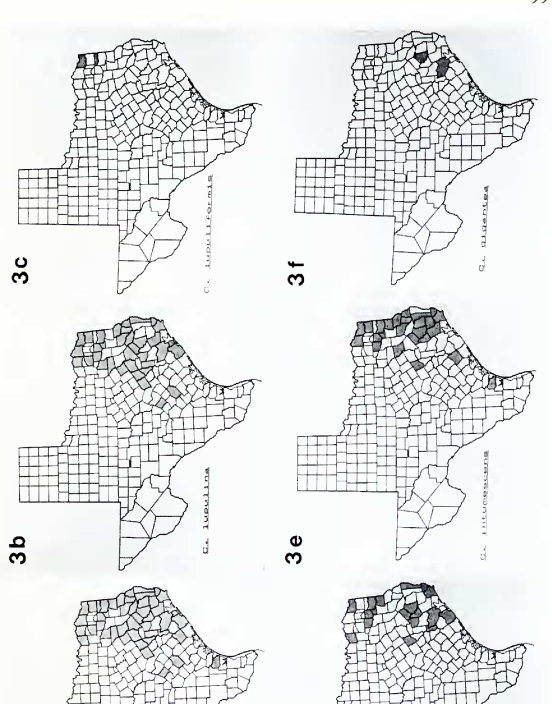

FIG. 3. a–f. Distribution by counties in Texas. 3a. Section *Lupulinae*. 3b. *Carex lupulina*. 3c. *C. lupuliformis*. 3d. *C. louisianica*. 3e. *C. intumescens*. 3f. *C. gigantea*.

anthers 1.7 – 2.4 mm long. Pistillate scales 4 – 9.5 mm long × 2 – 3.8 mm wide, lanceolate-ovate to ovate,(1-) 3-nerved, narrower and shorter than the perigynia, white hyaline with green centers, obtuse to awned, usually strongly cuspidate, awn to 6.5 mm long, antrorsely scabrous, Perigynia 10 – 17 mm long × 2.5 – 7.5 mm wide, broadly or narrowly ovoid, glabrous with a satiny luster, dark olive drab green, wingless, not corky, strongly inflated, usually spreading at all angles, sessile, (1-) 4 – 15 per spike, strongly 13 – 23-nerved; beak poorly defined, 2 – 4.2 mm long, bidentate. Achenes (Fig. 2e) 3.5 – 5.7 mm long ×(2.2-) 2.5 – 3.9 mm wide, ellipsoid to obovoid, trigonous, sessile, faces convex to nearly flat, angles not thickened. Distribution: Newfoundland to southeastern Manitoba, then southward to Texas and Florida. Texas: by counties (Fig. 3e); regions 1,2,3 and 4. Chromosome number $n = 24$ (Wahl 1940), 2 $n = 48$ (Reznicek and Ball 1974). Maturation dates: March through September. Habitat: Swampy woods, bottomland hardwood forests, acidic soils.

Representative specimens: **Anderson Co.**: 08 Sep 1971, *E. Nixon & R. Sniffen 3359* (ASTC). **Bowie Co.**: 10 May 1984, *E. Nixon 13752* (ASTC). **Cass Co.**: 17 May 1970, *D. Correll & H. Correll 38690* (TEX). **Galveston Co.**: 08 Apr 1975, *F. Waller & J. Baum 3506* (TAES). **Hardin Co.**: 28 Mar 1982, *J. Matos & D. Rudolf 347* (ASTC). **Harris Co.**: 23 Apr 1980, *J. Kessler 3385* (SMU,TAES,TEX). **Harrison Co.**: 06 Aug 1977, *E. Nixon & R. Hicks 7702* (ASTC). **Jasper Co.**: 19 Apr 1951, *E. Whitehouse 25036* (SMU). **Jefferson Co.**: 04 Apr 1946, *R. Crockett 8295* (TEX). **Nueces Co.**: 18 May 1933 Parks & Cory 22615 (TAES). **Orange Co.**: 22 May 1988, *S & G. Jones 1634* (ASTC,TAES). **Polk Co.**: 25 Apr 1937, *C. York & B. Tharp 43319* (TEX). **Red River Co.**: 29 Apr 1969, *D. Correll 37127* (SMU,TEX). **Sabine Co.**: 30 Mar 1971, *E. Nixon 2247* (ASTC). **San Augustine Co.**: 15 Apr 1987, *E. Nixon 15877* (ASTC,TAES). **San Jacinto Co.**: 11 Apr 1974, *D. Hartman 1308* (TAES). **Shelby Co.**: 05 Jul 1956, *D. Correll 15350* (SMU,TEX). **Trinity Co.**: 10 Jul 1988, *S. & G. Jones 1802* (TAES). **Tyler Co.**: 22 May 1988, *S. & G. Jones 1677* (TAES). **Upshur Co.**: 14 Apr 1916, *M. Young 113* (TEX). **Wharton Co.**: 07 Apr 1939, *B. Tharp 43272* (TEX). **Wood Co.**: 18 May 1988, *S. & G. Jones & E. Nixon 1440* (TAES).

5. Carex gigantea Rudge, "GIANT SEDGE", Trans. Linn. Soc. London 8:99. 1804. Type: (holotype: BM).

Blades flat, 2 – 6 dm long × 5 – 16 mm wide, long-attenuate, glabrous, upper half antrorsely scabrous on the margins, septate-nodulose. Bracts leaf-like, flat, 3 – 6 dm long × 6 – 11 mm wide, much exceeding the culm, antrorsely scabrous on the margins, sheathing, septate-nodulose. Pistillate infructescence (Fig. 1e), below staminate spike, 2 – 5 per culm, not aggregated or only very little, 3 – 8 cm long × 2 – 3 cm wide, oblong to cylindric; peduncles nearly sessile (4) cm long, smooth, distance between lowest 2 peduncles 5 – 20 cm; staminate inflorescence terminal, 1 – 5 per culm, 2 – 8 cm long × 2 – 4 mm wide, narrowly

linear; peduncles 2 – 8 cm long, smooth, base of staminate spike shorter than or not much exceeding top of uppermost pistillate spike; anthers 2.5 – 3.3 mm long (based on 5 specimens). Pistillate scales 4.5 – 10.5 mm long × 1.5 – 2 wide, lanceolate to lanceolate-ovate, 3 – 5-nerved, narrower and shorter than perigynia, white-stramineous hyaline with green centers, acuminate to awned, awns to 2.5 mm long, entire to slightly antrorsely scabrous. Perigynia 11 – 18 mm long × 4 – 6 mm wide, narrowly ovoid, glabrous, shiny, yellowish green to dark green, wingless, not corky, inflated, frequently spreading at right angles to main axis to slightly ascending, 20 – 75 per spike, strongly 17 – 22-nerved; beak conic, 6 – 9 mm long, bidentate. Achenes (Fig. 2c) 2.2 – 2.6 mm long 2.7 – 3.3 mm wide, obconic with subtruncate to truncate summit, trigonous, broadly stipatate, faces concave, angles thickened internally. Distribution: Florida to Texas, northward in the Mississippi Valley to Kentucky, Missouri and Indiana, east and northward to Delaware. Texas: by counties (Fig. 3f); regions 1 and 2 found only in Polk and Harris counties, rare. Chromosome number unknown. Maturation dates: May through September. Habitat: Swampy woodlands, acidic soils.

Representative specimens: **Harris** Co.: 16 Jul 1943, *E. Boon 224* (TEX). **Polk** Co.: 14 May 1942, *E. Brinklen 42 – 160* (TEX).

DISCUSSIONS

Reznicek and Ball (1974) stated that the series is clearly divided into two groups based on external morphology of the achenes. *Carex lupulina*, *C. lupuliformis*, *C. louisianica* and *C. gigantea* are in one group, and *C. intumescens* and *C. grayi* are in the other. Menapace et al. (1986) assessed the phenetic affiliation of species in section *Lupulinae* by examining achene epidermal micromorphology using scanning electron microscopy. Using silica platforms with or without central bodies in conjunction with macromorphological features, they supported the division of section *Lupulinae* into subsection *Lupulinae* (J. Carey) Kukenth., (*C. lupulina*, *C. lupuliformis*, *C. louisianica* and *C. gigantea*) and subsection *Intumescentes* Menapace, Wujek and Reznicek (*C. intumescens* and *C. grayi*).

Based on our examination of herbarium specimens *C. louisianica* of subsection *Lupulinae* is frequently confused with *C. intumescens*. Both species grow in the same habitat and have the same basic habit. However, *C. louisianica* (Fig. 1d) has subcylindric to cylindric pistillate spikes (ps), perigynia ascending to slightly spreading, perigynia drying to a light olive-drab green or stramineous brown in color, and the peduncle of the staminate spike (ss) greatly exceeds the uppermost pistillate spike. *Carex intumescens* (Fig. 1c) has subglobose to globose pistillate spikes (ps),

perigynia spreading at all angles, perigynia drying to dark olive-drab green, and the staminate spike (ss) moderately surpassing the uppermost pistillate spike. *Carex louisianica* (Fig. 1d) can be easily separated from *C. lupulina* (Fig. 1a) by the peduncle of the staminate spike (ss) of *C. louisianica* greatly exceeding the uppermost pistillate spike (ps). In *C. lupulina* the staminate spike rarely or slightly exceeds the uppermost pistillate spike.

Carex lupulina, a common species, is frequently confused with the rare *C. lupuliformis*. *Carex lupuliformis* has only been collected twice in Texas. The most recent collection was made in October of 1962. Morphologically they are similar and difficult to differentiate in the field. However, *C. lupulina* is most frequently found in open acidic swampy sites, swampy acidic forest edges and acidic roadside ditches associated with adjacent swamps, whereas *C. lupuliformis* is most frequently found in basic or calcareous swamps. *Carex lupulina*, variable in stature, can grow as large as *C. lupuliformis* under favorable conditions. However, *C. lupuliformis* is consistently the largest *Carex* of the section and one of the largest species of the genus in North America. Reznicek and Ball (1974) stated that when grown in favorable conditions, *C. lupuliformis* is certainly one of the largest and most stately of *Carex* in Canada and also one of the rarest. The achenes of *C. lupuliformis* (Fig. 2d) are the best diagnostic character. They have pointed angles with nipple-like knobs and deeply concave faces. Achenes of *C. lupulina* (Fig. 2a) have neither pointed angles nor nipple-like knobs and the faces are flat to slightly concave. We concur with Reznicek and Ball (op. cit.) that Willdenow is the correct authority of *C. lupulina*.

Carex gigantea, like *C. lupuliformis*, has only been collected twice in Texas. The most recent collection was made in July 1943. Site locations listed on the herbarium labels for both collections are unclear making original locations impossible to find. If these two species are found to be extant in Texas, then serious consideration should be made by the Texas Organization for Endangered Species to list both species as "state endangered species" as defined by Beaty and Mahler (1987).

ACKNOWLEDGMENTS

We thank Gretchen D. Jones for help in the overall preparation of the plates and for editorial comments. Editorial comments from Hugh D. Wilson, J.K. Wipff and David Castaner are also appreciated. We thank the curators from all herbaria from which loans were made; making this research possible. We acknowledge Texas A&M Electron Microscopy Center for the use of their equipment. This is Technical Bulletin TA 24828, Texas Agricultural Experiment Station.

REFERENCES

BEATY, H.E. and WM. E MAHLER, revisors 1987. Endangered, threatened, & watch lists of plants of Texas. 2nd rev. Texas Organization for Endangered Species, Austin, Texas.

CORRELL, D.S. and M.C. JOHNSTON. 1970. Manual of the vascular plants of Texas. Texas Research Foundation, Renner, Texas.

FERNALD, M.L. 1950. Gray's manual of botany. 8th ed. Van Nostrand Reimhold Company, New York.

GLEASON, H.A. 1952. Illustrated flora of the northeastern United States and adjacent Canada. Hafner Publishing Company, New York.

GOULD, F.W. 1975. Texas Plants—a checklist and ecological summary. Tex. Agric. Exp. Sta. Bull. MP-585.

HOLMGREN, P.K., W. KEUKEN and E.K. SCHOFIELD, compilers 1981. Index herbariorum I Ed. 7. W. Junk B. V., The Hague.

MACKENZIE, K.K. 1935. Cyperaceae. Cariceae. North Am. flora, 18:393 – 478.

-----. 1940. North American Cariceae. New York Bot. Gard. Vol. 2. New York.

MENAPACE, E.J., D.E. WUJEK and A.A. REZNICEK. 1986. A systematic revision of the genus *Carex* (Cyperaceae) with respect to the section *Lupulinae*. Can. J. Bot. 64:2785 – 2788.

REZNICEK, A.A. and P.W. BALL. 1974. The taxonomy of *Carex* series *Lupulinae* in Canada. Can. J. Bot. 52:2387 – 2399.

STEYERMARK, J.A. 1968. Flora of Missouri. The Iowa State Univ. Press. Ames, Iowa.

VOSS, E.G. 1972. Michigan flora. Part 1. Gymnosperms and monocots. Cranbrook Inst. Sci. Bull. 55.

WAHL, H.A. 1940. Chromosome numbers and meiosis in the genus *Carex*. Amer. J. Bot. 27:458 – 570.

WATERFALL, U.T. 1979. Keys to the flora of Oklahoma. 6th ed. Published privately, Stillwater, Oklahoma.